Whitepaper

Beyond the Web Viewer:

A Software Solution for Secure Cross-platform Radiology Records Distribution

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***Abstract*— The healthcare industry has seen several new US legislative actions with the purpose of organizing health information systems across disparate groups of healthcare providers. The autonomy that providers enjoy in the US healthcare landscape is unique in managing health information and has created a system of isolated health records across the continuum of care. While this legislation is an important part of stimulating healthcare organizations to build infrastructure to share patient records, in practice the effort is much more complex and time consuming. This is especially true in the radiology market where multiple standards are used in the storage of medical records and not widely adopted by the larger healthcare community. In the radiology market this issue has been addressed through the use of web viewers allowing physicians secure *access* to their patient's records. This whitepaper suggests a logically coupled software solution to enable physicians to seamlessly *acquire and store* relevant medical records for use in their electronic medical record (EMR).**

***Index Terms*—PACS, SOA, DICOM, HL7, XDS, XDS-I, HITECH, IHE**

The Health Records Problem

Typical electronic medical record systems attempt to store a patient's entire medical record in an electronic form. Although many physicians continue to maintain that medical records in an electronic form are more cumbersome than their paper counterparts, their adoption has been accepted as an important step in making medical records more portable. By managing this information in electronic form physicians would be enabled to more easily share records between systems.

Like most information technology systems, it is standards that have made this transfer of electronic information feasible. Prior to healthcare information systems standards such as HL7, EDI (X.12) and XDS, attempts to share this information have involved customized, proprietary solutions on a small scale. Consequently the healthcare market space was littered with failed attempts for meaningful exchange of records between disparate or loosely coupled systems.

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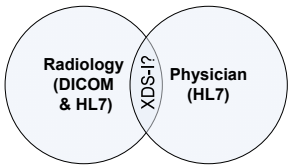
While HL7 and other standards have provided a means to share information, radiology is not able to fully take advantage of a shared standard with their referring physicians; while they may have implemented systems capable of handling standards such as HL7, many EMR vendors do not implement the DICOM standard which is widely used in medical imaging.



In a typical radiology workflow, the patient is seen by a physician who refers the patient to the radiologist for medical imaging studies. The radiologist practice produces and stores two distinct datasets related to the study; the image data used in determining the patient's pathology as well as a final report. While the final report can be easily ported to an HL7 format, HL7 does not have support for the image data which is arguably as important as the report. In order to support this, EMRs would need to implement the DICOM standard in order to manage the image data in a meaningful way.

In addition to the lack of DICOM implementation in EMRs, there also exists the challenge of transmitting HL7 data. While HL7's latest versions include the ability to use web services and service oriented architecture to reduce the need for dedicated VPNs, many legacy radiology information systems have not added this support. Without being able to leverage the newer features in HL7, radiology practices have little choice but to share data using standards developed in the 1990's.

The Government "Fixed" It

In early 2008 the US Federal government enacted various laws as part of its economic stimulus package and the HITECH Act which mandates "meaningful use" of electronic medical records across all areas of healthcare by 2012. The law not only mandates meaningful use by providers in order to receive their full reimbursements for Medicare and Medicaid, but also puts forth a mandate for the Department of Health and Human Services to certify EMR vendors that demonstrate their ability to provide for "meaningful use".

HITECH requires integration between health record systems. Web viewers provide "access" to data, but to fully realize the benefit of an EMR, this data must be acquired and stored in the EMR.

This has spurred development and implementation of EMR systems capable of sharing their records in a more seamless way than in the past, and there is no doubt this will have a positive impact on patient care and reducing healthcare costs. However, without a framework for sharing medical imaging data, this leaves radiology with little to gain from legislative and government intervention. In fact, it may produce additional concerns for radiology practices as referring physicians begin demanding similar integration they experience with other 3rd parties such as diagnostic testing services that produce data more appropriate to the frameworks that currently exist.

An Example from Diagnostic Testing

Diagnostic testing services have been providing electronic results to physicians that can be easily integrated into practice management systems long before intervention from the Federal government. Two distinctions set these lab companies apart from radiology: 1. They produce results where the textual data can be easily ported to HL7 without the need for other standards, and 2. Laboratory companies tend to be much larger than their radiology counterparts. The two companies listed above have combined revenue over $10 billion dollars and nearly 100,000 employees (radiology organizations rarely measure their revenue in billions).

Producing data that lends itself to delivering text based results is a large factor in laboratory company's superior integration with the physician office. Compared to radiology practices, their nearly unlimited information technology resources and additional business clout to arrange for results integrated directly to the EMR vendor greatly enhances their ability to produce more seamless integrations. With limited financial and IT resources, radiology practices are left to attempt to provide the same level service, but with more complications when attempting to deliver both the final report and image data.

Although negotiating blanket license fees with the EMR vendors may not be feasible in the radiology market, an alternative method used by these companies is the use of a free software client used to download the lab results to a PC in the doctor's office. Once downloaded, this application can send the results using HL7, or store them locally. This solution allows those referring physicians who do not have EMRs, or if the EMR does not support the diagnostic testing company, to receive and store their patient's results.

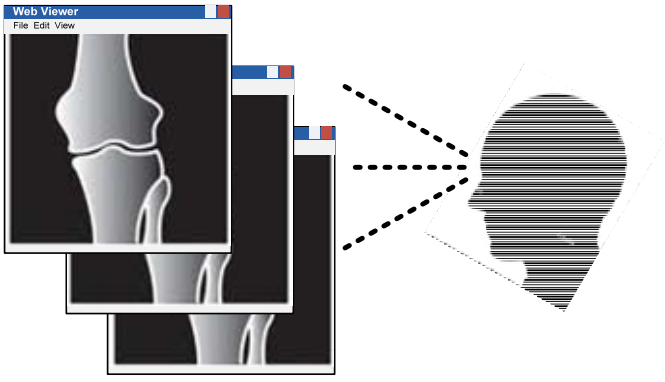
Another electronic option is accessing these results using a web portal. This solution has been in use in the radiology market as well, but has some disadvantages.

The Web Viewer

The web viewer has become ubiquitous in the radiology market for easily sharing images and reports with referring physicians. Typically, the radiology practice hosts a web server which integrates to their PACS. Physicians log into a web portal which allows them to review images and reports for patients which they have referred to the radiology practice. Web viewers have seen widespread growth in the last decade because their use not only enhances the referring physician's ability to review studies, but also provides the radiology practice a strategic advantage and marketing tool.

While the web viewer has undeniable benefits, in recent years disadvantages have also emerged. IT security has forced some larger practices to abandon the use of certain third party web applications due to their reliance on web client technologies such as Java and ActiveX that may not be compatible with local IT security policies.

Although these issues can be mitigated with XDS-I there still remains the issue at the core of healthcare's shift to EMR—single point of access to the medical record. While the web viewer allows the physician access to the radiology records, she must use separate systems to access those records from various practices. If the physician refers patients to several radiology practices, she may have many web portals she must utilize to access medical imaging data.



Using a software client at the referring physician's office, the reports and image data are "pulled" to the physician practice and can be integrated with an EMR using a variety of standards such as HL7, DICOM, XDS-I, REST and others.

Furthermore, web viewers do not typically incorporate critical results functionality that the EMR may natively support, such as alerting the physician to diagnoses that may be life threatening or require follow-up. These functions must remain out-of-band from the EMR and web viewer thus subject to human error. Office staff at either the radiology practice or physician office are then required to manually screen for critical results and inform the physician or patient.

Lab Markets

In researching a solution to this growing problem of bridging the EMR to PACS, one can look to the diagnostic testing industry for methods that have yielded closer integration to the referring physician's EMR. One challenge is overcoming the license and software fees charged by many legacy practice management systems vendors for accepting results using HL7 from third parties. In some cases, this issue is overcome by the diagnostic testing company by forming business relationships with the EMR vendors directly and assuring the referring physician that cost of integration is the burden of the diagnostic testing provider.

Unfortunately, many radiology providers will find it difficult to forge these business relationships on a large scale due to their limited IT and financial resources as compared to the diagnostic testing companies engaged in this practice.

Another option is installing software at the providers' practice that can leverage a web based system for bringing the results into the referring provider's practice. Once the data resides on a local software application, it can be transmitted locally to an EMR via HL7, printed on a standard printer, saved and accessed electronically with a software application, or saved on storage media.

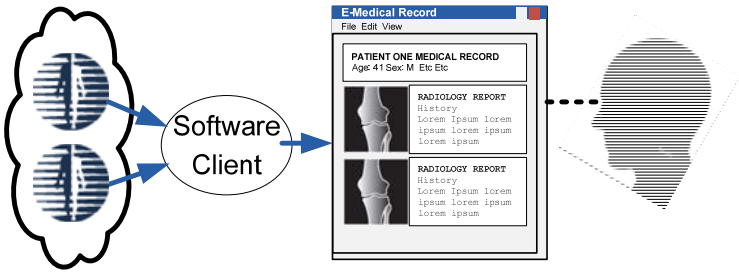
Report and Image Distribution using UltraDISTRIBUTOR

UltraRAD recently implemented the latter solution for Steinberg Diagnostic Medical Imaging, a radiology practice in Las Vegas NV. The practice consists of 5 outpatient radiology imaging centers, producing over 300,000 studies per year service 3,000 referring physicians. Using the software model of the diagnostic testing providers as an example, an application was designed that allows reports and DICOM image data to be "sent" to the providers electronically, giving them the option to integrate this data directly to the EMR.

When a patient is registered in their Intergy radiology information system, an HL7 message with the order details is sent to a server with the order details, including the referring physician who ordered the study. This information is indexed and saved on the server to reference the referring physician once the study is completed.

Once the study is completed, it is sent to the existing McKesson PACS. A radiologist performs the diagnostic interpretation, and produces a final report using Powerscribe, which transmits the final report to Intergy as well as UltraDISTRIBUTOR. Once finalized, UltraDISTRIBUTOR checks if the referring physician is configured to receive the results and images, and if necessary 'pulls' the DICOM image data from the McKesson PACS.

Referring practices opting in for electronic distribution receive a free application that periodically "polls" the UltraDISTRIBUTOR server for exams waiting. Using web services, the exams are automatically fetched from UltraDISTRIBUTOR and stored locally in the software client. While the software client can be easily installed and configured by the user at the referring provider, the radiology practice in this case opted to provide field representatives to help the facility fully utilize the software client.



The referring practice can chose to simply print results and review images in a reference DICOM viewer within the client, or transmit the results and/or images to a third party EMR or practice management system. Typically this is done using HL7, with configurable options for generating messages compatible with the third party vendor.

Since many EMR systems do not currently support storage or visualization of the DICOM data, a REST (REpresentational State Transfer) web interface is also included in the software client. Many EMRs support the use of REST for display of third party data in web browser. This is simply a URL constructed dynamically on the EMR that contains patient or study data that can be used by the software client to load the studies in a web viewer. The software client used by UltraDISTRIBUTOR uses UltraRAD's clientless web viewer which requires no third party components such as ActiveX or Java.

Using UltraDISTRIBUTOR, Steinberg Diagnostic is able to provide a framework for their referring physicians to both access and integrate radiology reports and images from the EMR. This not only gives the group a unique strategic advantage in the competitive Las Vegas radiology market, but also enhances patient care and helps providers move closer to meaningful use of electronic medical records. One framework for implementing meaningful use is the IHE standards.

Patient Indexes

Sharing records is only half the battle, the question remains on how to ensure these electronic records are properly married to the patient's medical record as it moves between electronic systems. In the 1990's, the Clinton administration suggested a national patient identifier be created that would follow patients regardless of their point of care. While this system would have solved much of the problems we face today in merging electronic health records, it lacked public support and fizzled before it came to fruition.

In the absence of a national patient identifier, other methods must be used to match patient records. One solution is to implement a master patient index (MPI) which is software that maintains a mapping of patient identifiers for various facilities, allowing providers to query for patient identifiers for other patients. This technique has been gaining popularity in regional health information organizations as a way to simplify patient matching. Unfortunately, their use is not yet widespread and many radiology practices will find this solution impractical.

The American Health Information Management Association (AHIMA) has recommendations for matching patient records in the absence of an MPI. Using UltraDISTRIBUTOR, the meta data in the referring practices EMR and the radiology information system can be compared, and using a tiered approach can be matched with best effort. For example, if the social security number is available in both datasets, and the last name and date of birth can verified, it is reasonable to assume the records are a match and can be merged. If a match cannot be found using this method, the first name, last name, date of birth, gender and ZIP code could be compared. There are more complex matching methods employed by some MPIs that include phonetic matching, spelling equivalents, etc but these may be more complex than is required; users can manually correct and match sets of data that fail to automatically match.

"…in a world where most clinical results are stored electronically, intelligent clinical data distribution is the future. This sort of distribution also opens up many opportunities for our referring base to comply with government regulations regarding "meaningful use" and potentially collect benefits based on the interoperability of clinical system like PACS, EMR and local community health exchange systems"

Don Shackley, CIO
Steinberg Diagnostic
Medical Imaging
Las Vegas NV

An early adopter of UltraDISTRIBUTOR implemented an interesting solution; they provide a web portal for their physicians to request studies that collects the patient demographics as well as the EMR's medical record number. This ensures that the demographics used at the radiology practice match those used in the referring's EMR increasing the odds of automated positive matches in UltraDISTRIBUTOR.

Future Compatibility

Although standards such as XDS and XDS-I have not seen widespread adoption in healthcare, these and other standards that help move closer to the IHE standard are a natural evolution of healthcare information systems. With the recent passing of laws requiring sharing information, IHE provides a roadmap for compliance in the radiology market.

One challenge with implementing XDS and XDS-I is the lack of widespread adoption not only within radiology, but the entire healthcare information systems landscape. A solution that will work today may not be able to take advantage of the benefits of XDS-I, but a sound solution would provide for future use of these standards.

UltraDISTRIBUTOR provides a method for bridging disparate protocols through the resident software client at the referring physician practice. Although many practices do not currently have access to EMRs that can integrate using HL7 v3 or XDS, as these systems come to market UltraDISTRIBUTOR allows these systems to immediately take advantage of modern standards. This not only provides for future compatibility of the radiology practice's image and report distribution but can also stimulate adoption of these new standards since physicians can be confident they will realize a return on their investment of new technology taking advantage of these new standards.

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